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THE INCIDENCE OF MENINGOCOCCUS CARRIERS IN A NAVAL TRAINING STATION DURING 1918

JOHN T. SHORT
U. S. Naval Training Station, Great Lakes, Ill.

With the appearance of epidemic cerebrospinal fever at various camps throughout this country shortly after mobilization in 1917, the policy of searching for meningococcus carriers practiced by British medical officers in 1915 and 1916,[1] was generally adopted. At the U. S. Naval Training Station at Great Lakes, Ill., the impetus for this work was given by a sharp outbreak of the disease in April and May, 1917. Since the carrier situation previous to this epidemic was unknown and the decline in new cases had begun before the work was far advanced, these studies threw little light on the problem at that time. As the summer advanced, however, nasopharyngeal cultures were made more and more extensively until they included routine cultures of all men entering and leaving the station and also of the probable contacts of cases, as detailed in a previous report.[2] In consequence, a reliable and uniform technic was gradually perfected and the general carrier index of the station determined. The subsequent occurrence of an epidemic of cerebrospinal fever that winter gave an excellent opportunity of studying its relations to meningococcus carriers and to other factors which possibly influence the variations in carrier incidence, as followed during the succeeding year.

In the preparation of the accompanying chart the curve of meningococcus carriers has been constructed on a percentage basis (of men examined) so that in spite of the variable number of men cultured each week, a constant factor is determined to indicate the relative prevalence of carriers for any particular period. The results obtained by culturing contacts of meningitis patients are included in this curve as well as those from routine cultures of incoming and outgoing men.

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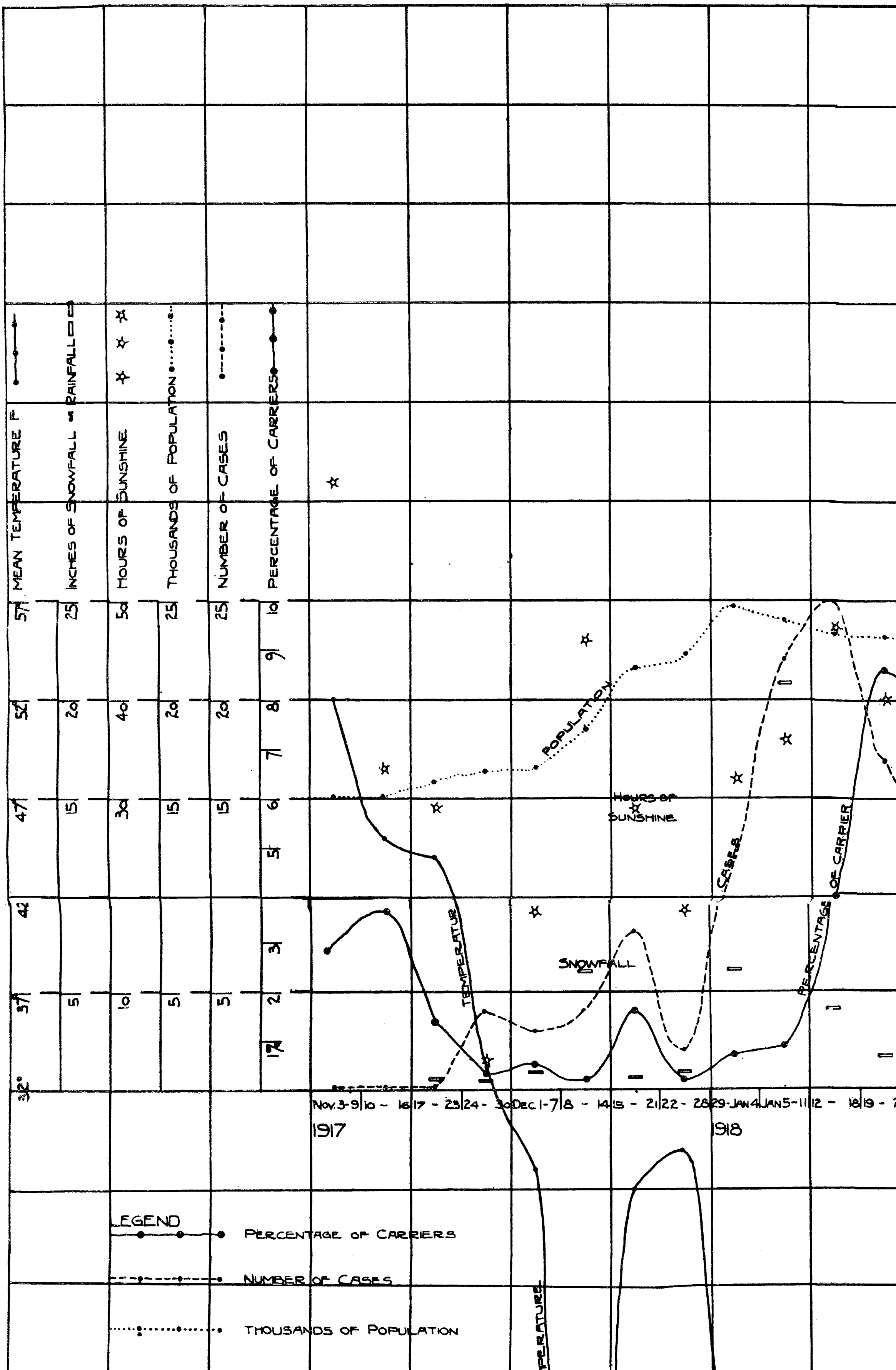
[1] Gordon: Bacteriological Measures Adopted for Dealing with the Military Outbreak in February, 1915, and Improvement Expected as the Result of Research. Special Report of the Indicated Research Committee on Bacteriological Studies in the Pathology Prevention, and Control of Cerebrospinal Fever among the Forces during 1915 and 1916. London, T. Fisher Unwin, 1917.

[2] Short, J. T.: U. S. Nav. Med. Bull., 1918, 12, p. 627.

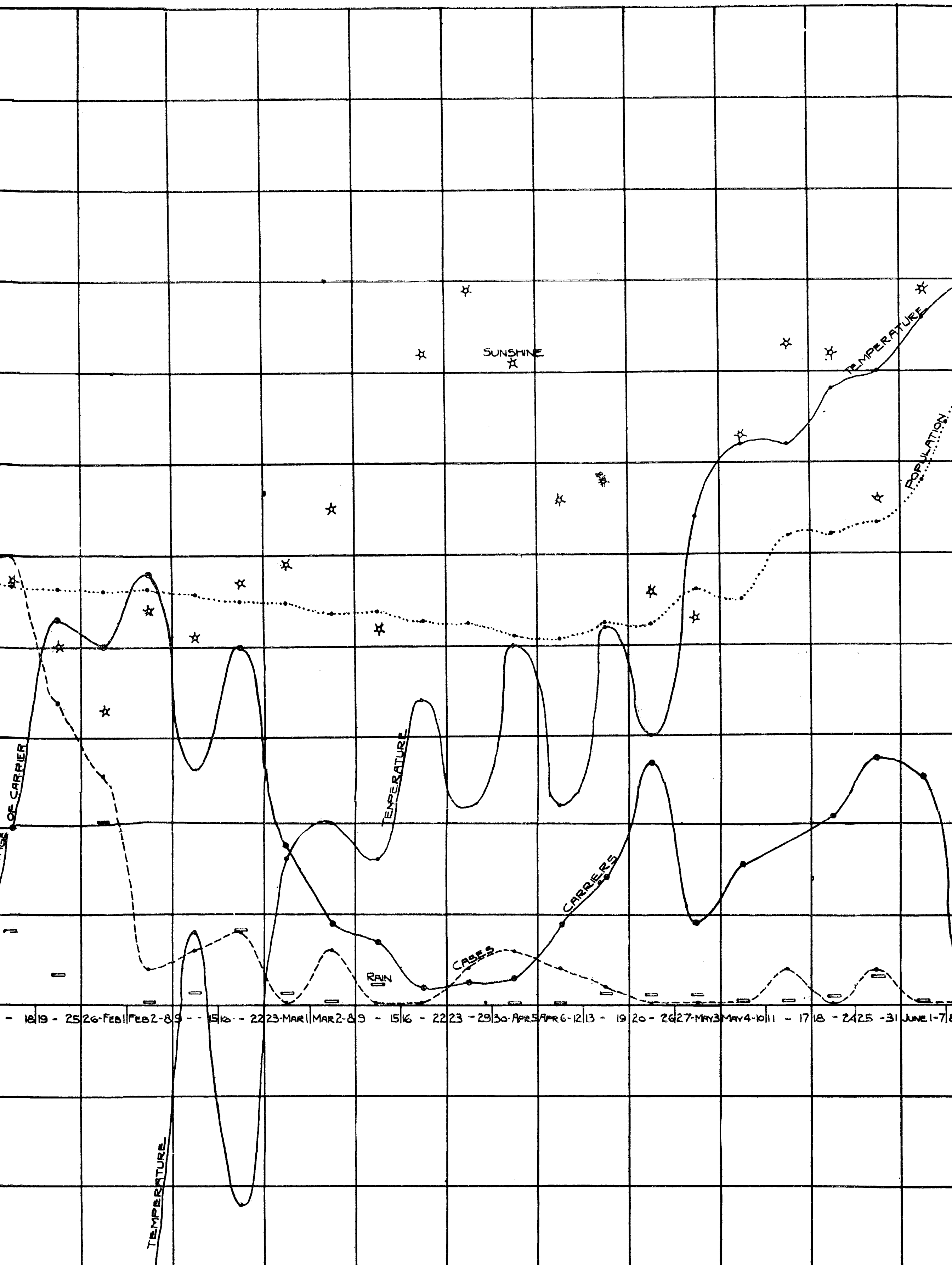
A curve showing the total number of new cerebrospinal fever cases each week has been superimposed. The mean temperature each week has been shown graphically, and other weather conditions have been indicated by the total number of hours of sunshine and the total snowfall or rainfall in inches for each week. Variations in the complement of the station are shown by a plot of the average weekly population.

It will be seen at once that although there was a sudden rise of cerebrospinal fever early in January there was no previous increase over the usual carrier index which did not begin to rise until the middle of January, two weeks later; while the peak of the carrier curve occurs three weeks after the time of the greatest case incidence, and the percentage of carriers continues high for several weeks after the case curve has begun to decline. The smaller rise in carriers and cases during December, 1917, is synchronous in this chart, but on plotting the daily figures the rise in carriers is found to come a week later. This relation cannot be demonstrated in the rise shown in October, 1918, owing to the lapse of several days during this period when no cultures were taken. On account of the time factor brought out by the comparison of these two curves, it is difficult to account for the new cases on a basis of an increase in carriers, and it seems more logical to assume that the carriers are the result rather than the cause of the epidemic. Strength is further added to this assumption by the fact that while the small number of known carriers who preceded the epidemic had been very carefully isolated, on Jan. 28, 1918 (when the carrier incidence had nearly reached its height) the restrictions on carriers were largely removed and no attempt was made to isolate those subsequently discovered. In spite of the great prevalence of unrestricted carriers when just beyond the peak of the case curve, the epidemic continued to decline. Another instance of the comparative harmlessness of carriers may be noted in this connection. A carrier (C. R. F.) who had been in isolation for several months at this time was placed on duty in an office under ordinary conditions. Cultures were taken at regular intervals and were continued in all over a year. At no time could he have been discharged under the system of obtaining three successive negative cultures, and yet, in spite of his carrying this organism for a year without any especial precautions no new cases of the disease developed among his associates, nor could any new cases be traced to this carrier.


MEAN TEMPERATURE F
INCHES OF SNOWFALL or RAINFALL
HOURS OF SUNSHINE
THOUSANDS OF POPULATION
NUMBER OF CASES
PERCENTAGE OF CARRIERS
57 25 50 25 25 10
9
52 20 40 20 20 8
7
47 15 30 15 15 6
5
42
3
37 5 10 5 5 2
1%
32°
POPULATION
HOURS OF SUNSHINE
CASES
PERCENTAGE OF CARRIER
TEMPERATURE
SNOWFALL
Nov. 3-9 10 - 16 17 - 23 24 - 30 Dec. 1-7 8 - 14 15 - 21 22 - 28 29-Jan 4 Jan 5-11 12 - 18 19 - 2
1917
1918
LEGEND
PERCENTAGE OF CARRIERS
NUMBER OF CASES
THOUSANDS OF POPULATION
PERATURE

COMPARED WITH WEATHER COND

GREAT LAKES, ILLINOIS. 1



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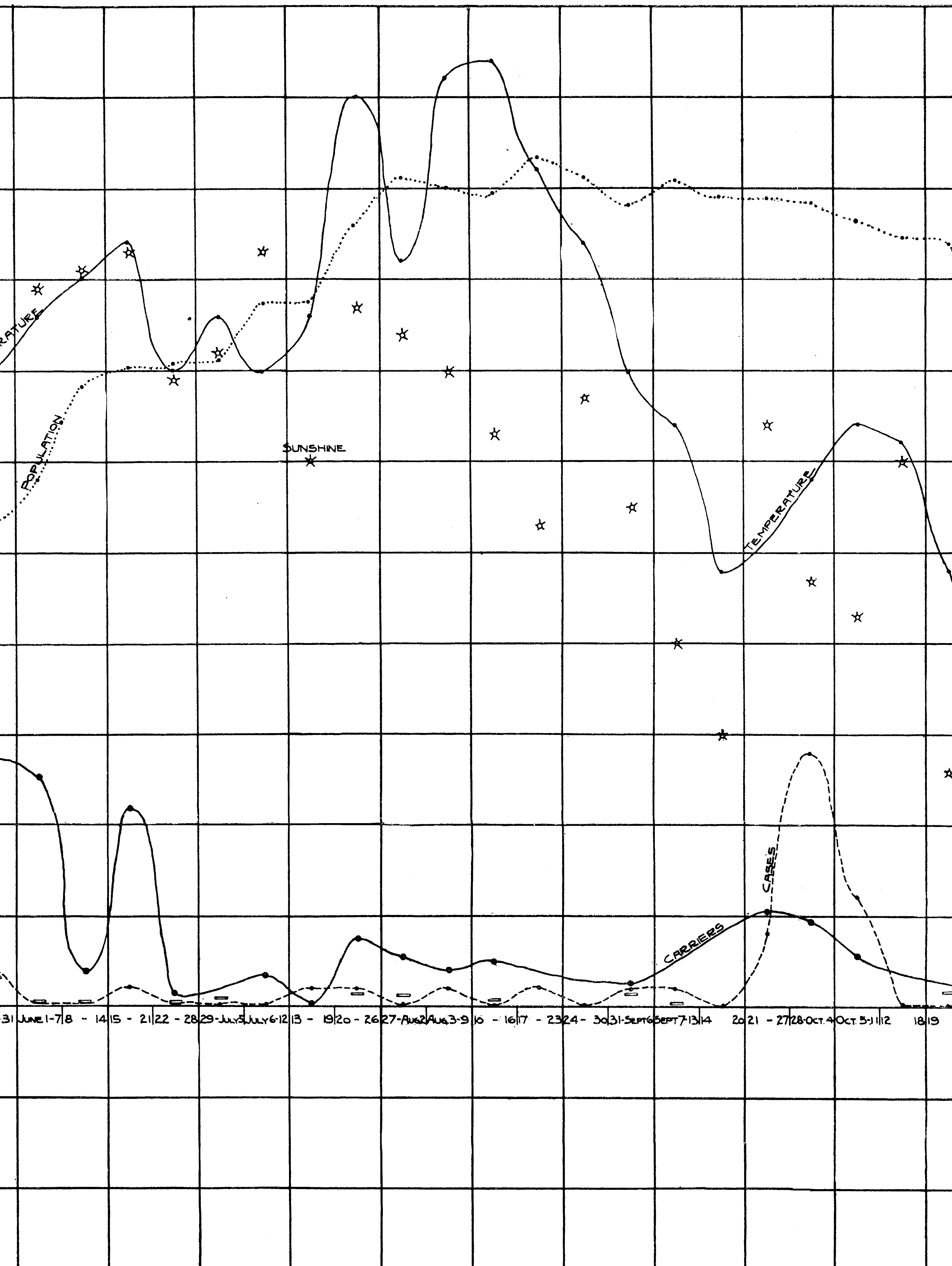
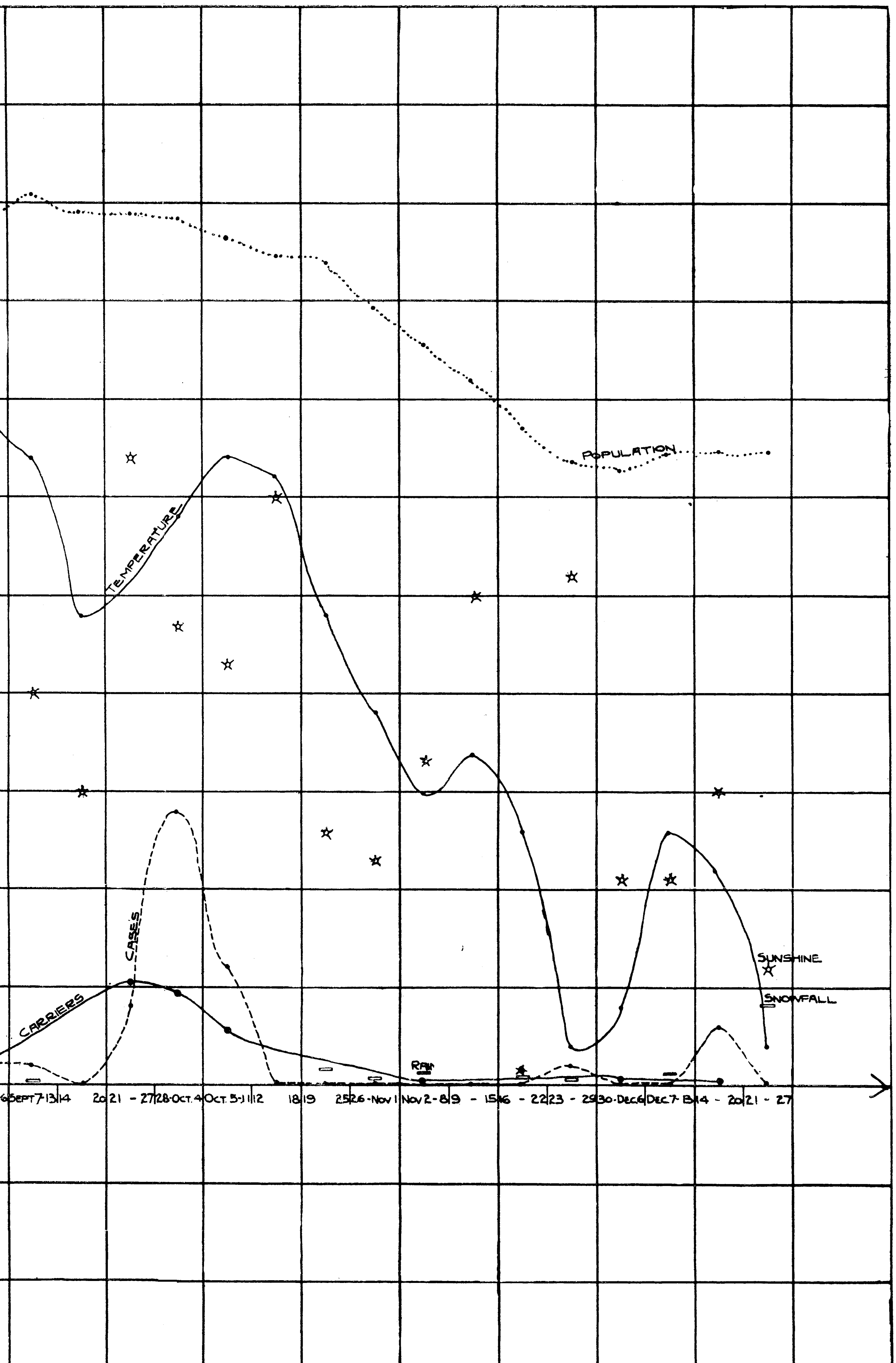
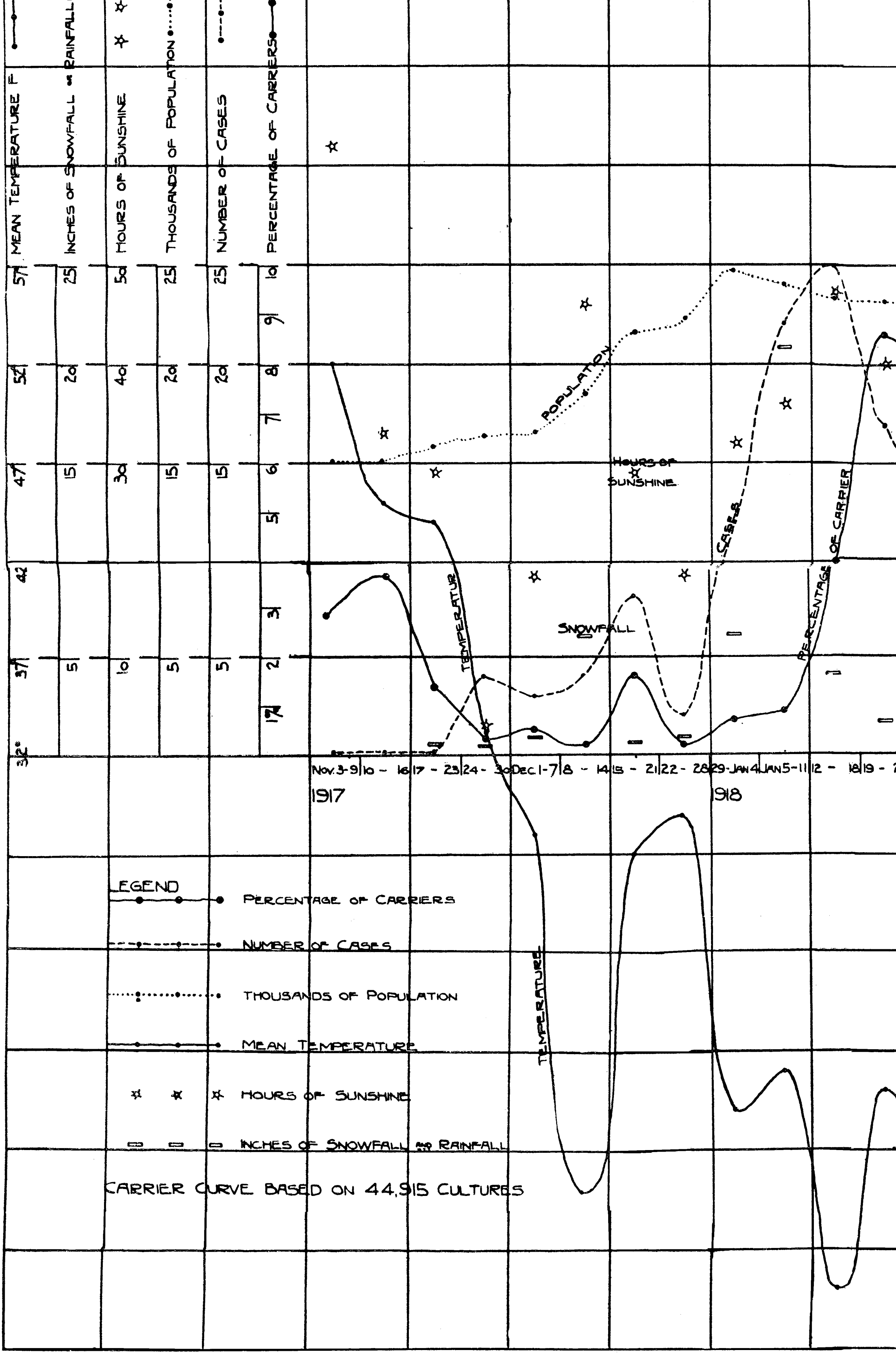
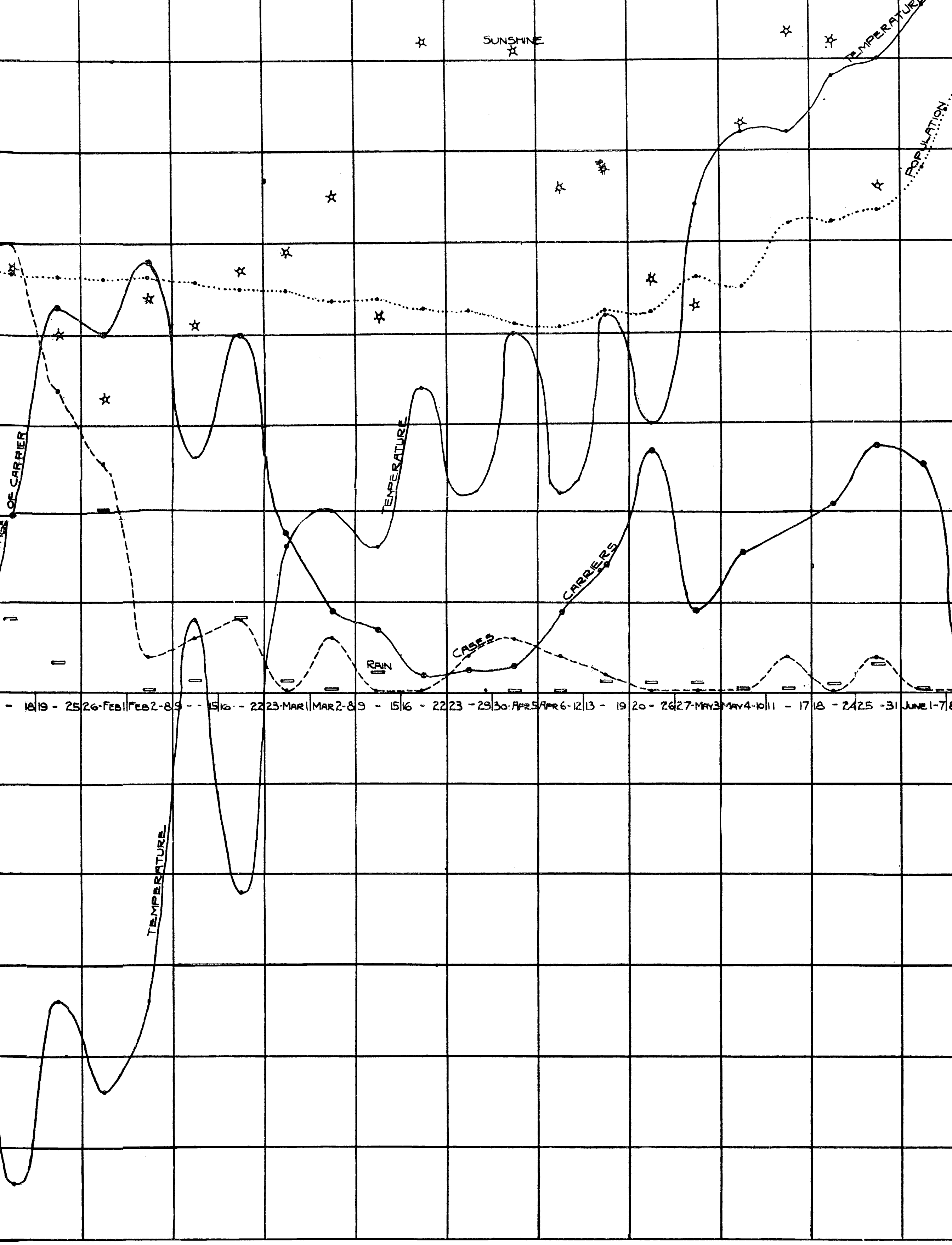
LINOIS. 1918

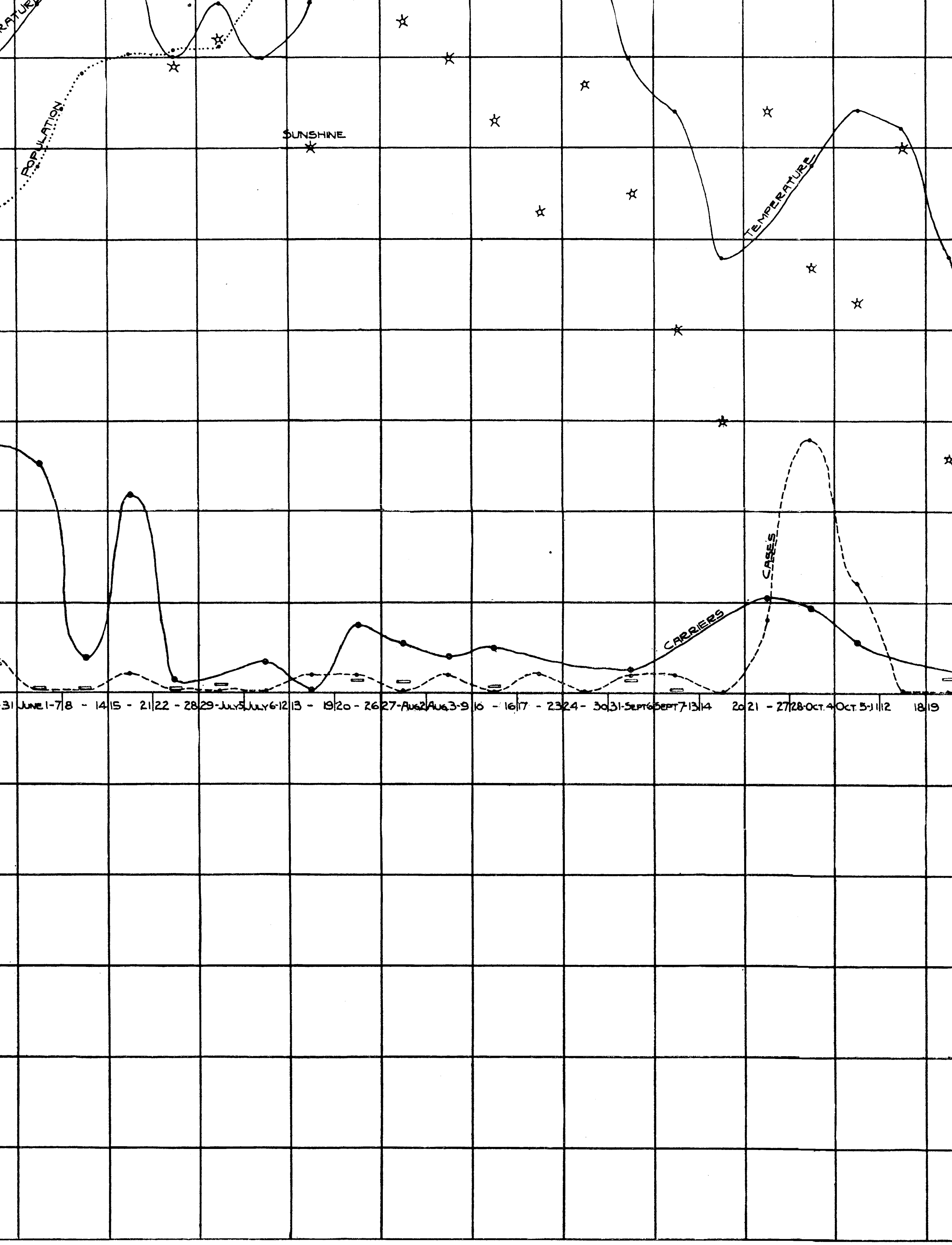



POPULATION
TEMPERATURE
SUNSHINE
SNOWFALL
RAIN
CASES
CARRIERS
6 SEPT 7-13
14 - 20
21 - 27
28-OCT. 4
OCT. 5-11
12 - 18
19 - 25
26-NOV 1
NOV 2-8
9 - 15
16 - 22
23 - 29
30-DEC 6
DEC 7-13
14 - 20
21 - 27

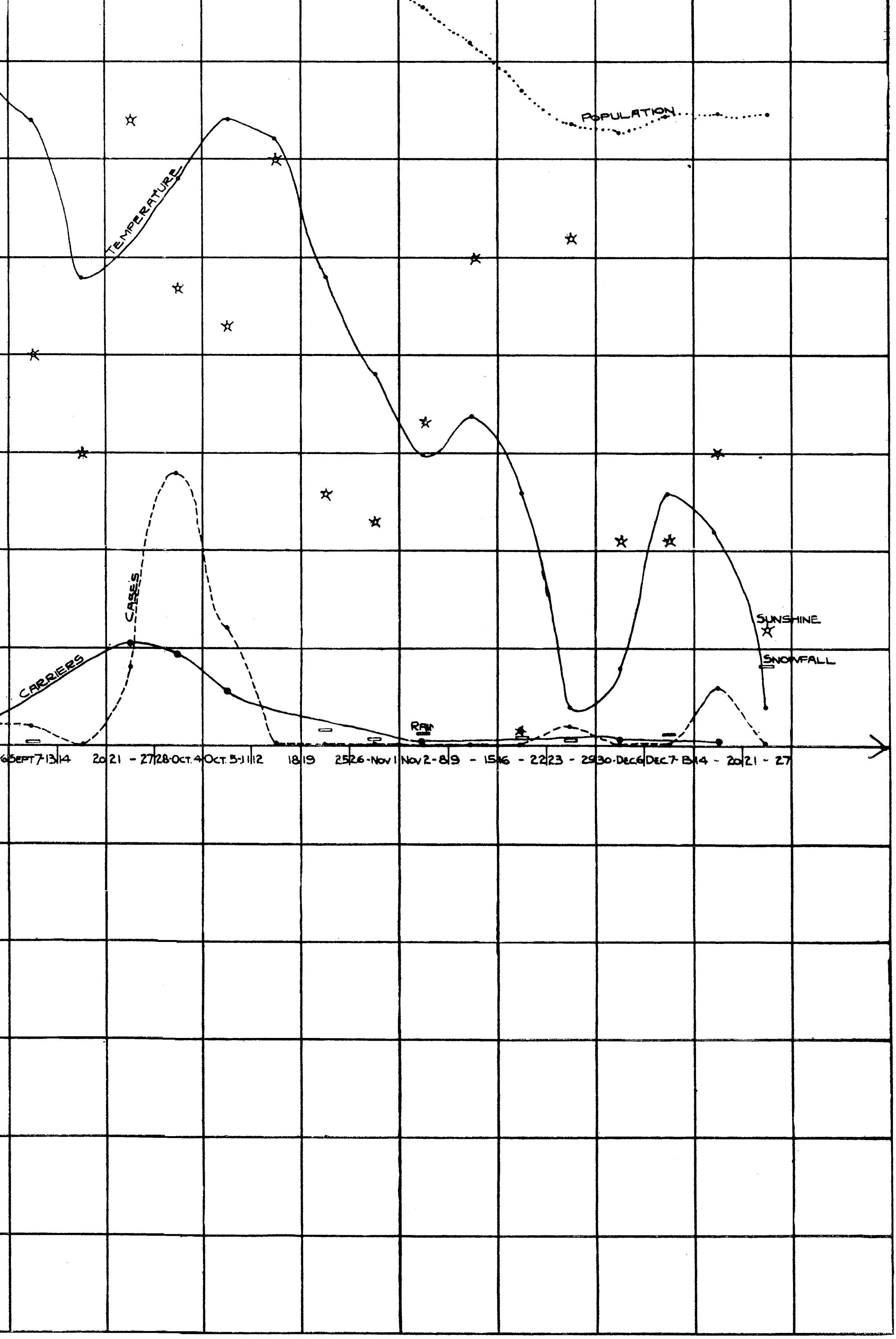

Mean Temperature F
Inches of Snowfall or Rainfall
Hours of Sunshine
Thousands of Population
Number of Cases
Percentage of Carriers
57
52
47
42
37
32°
25
20
15
5
50
40
30
10
25
20
15
5
25
20
15
5
10
9
8
7
6
5
3
2
1½
Population
Hours of Sunshine
Cases
Percentage of Carrier
Snowfall
Temperatur
Percentage
Temperature
Nov. 3-9
10 - 16
17 - 23
24 - 30
Dec. 1-7
8 - 14
15 - 21
22 - 28
29-Jan 4
Jan 5-11
12 - 18
19 -
1917
1918
Legend
Percentage of Carriers
Number of Cases
Thousands of Population
Mean Temperature
Hours of Sunshine
Inches of Snowfall and Rainfall
Carrier Curve based on 44,915 Cultures



INCIDENCE OF CEREBROSPINAL FEVER AND MENINGOCOCCUS CARRIERS COMPARED WIT



RED WITH WEATHER CONDITIONS, GREAT LAKES, ILL., 1918.


POPULATION
TEMPERATURE
CASES
CARRIERS
RAIN
SUNSHINE
SNOWFALL
6 SEPT 7-13 14
20 21 - 27 28-OCT. 4 OCT. 5-11 12
18 19
25 26-NOV 1 NOV 2-8 9 - 15 16 - 22 23 - 29 30-DEC 6 DEC 7-13 14 - 20 21 - 27

The curve of weather conditions is interesting in that the period of coldest weather and heaviest snowfall, January and early February, 1918, almost exactly coincides with the period showing the greatest number of cases of the disease. It is also noteworthy that the high carrier rate after this epidemic continues until the advent of warm fair weather.

Rapid growth of the station as a factor in meningitis incidence is indicated to some extent by the population curve. It should be noted that the first rise in population which preceded the epidemic took place during cold weather at a time when added housing facilities were not readily available. The second rapid rise occurred in the summer of 1918 with no corresponding rise in either cerebrospinal fever or meningococcus carriers, but in this instance crowding was largely offset by the larger number of buildings completed at this time and the fact that tents were freely used during this warm season to house the overflow of men.

The sharp outbreak of meningitis in October is best accounted for by the lowered general resistance which followed the visitation of the influenza pandemic during September. That meningitis did not again assume the epidemic proportions that prevailed the previous winter might be due to several factors, such as the milder weather, more seasoned personnel, decreasing population or even the low carrier index which prevailed, although the reverse of the last proposition is equally tenable.

It is not the intention in this paper, however, to assign the reason for the occurrence or non-occurrence of cerebrospinal fever or meningococcus carriers, but rather to call attention to the multiplicity of factors which may be reasonably expected to operate alone or in combination to influence this incidence; to emphasize that the meningococcus carrier is only one of these factors, of which crowding, overtraining, immaturity, fatigue, exposure to weather and other factors discussed in a previous report[2] are probably equal, if not greater, in importance; and that to concentrate our attention on any one factor to the exclusion of a proportionate regard for the others, is to neglect some of the opportunities for controlling the situation.